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THE NEPIDÆ IN NORTH AMERICA NORTH OF MEXICO,
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The Nepidæ of North America.

(Further Studies in Aquatic Hemiptera.)

BY H. B. HUNGERFORD.

ACKNOWLEDGEMENTS.

I WISH herewith to acknowledge my indebtedness to those who have rendered assistance in the preparation of this paper, which had its beginning several years ago. I am under especial obligation to Dr. L. O. Howard, Dr. J. M. Aldrich, and Mr. W. L. McAtee for the opportunity they gave me to study in the United States National Museum, where are located some of the types of Doctor Montandon and the Kirkaldy and Uhler collections of these insects. In addition to the material at the United States National Museum, I have been permitted to examine the collections of Mr. J. R. de la Torre Bueno, of Dr. Carl J. Drake and have had, beside our own University collections, abundant material so generously supplied by Mr. W. E. Hoffmann and Doctor Knight, of the University of Minnesota, and by Mrs. Grace Wiley from collections in Texas. Professor Brimley, of Raleigh, N. C., also supplied me with two species for study. Miss Kathleen Doering made most of the drawings and Mr. P. A. Readio and Mr. Raymond Beamer helped me with the photographs.

INTRODUCTION.

The subtle characters and elusive specific differences between the various species of the cryptocerate groups of the Hemiptera have made it difficult to fix specific limits. The students of these groups have resorted, therefore, to comparisons that are beyond the comprehension of the general systematist endeavoring to identify his collection. Such comparative notes become intelligible only after a prolonged study of the insect group concerned, and this condition

has worked against there being a very large number of students who have found the time and inclination to identify the species in such families as the Notonectidæ, Nepidæ and Corixidæ, for instance.

The difficulty encountered by the writer in sorting and naming the aquatic bugs in the course of his biological studies led to a thorough investigation for diagnostic characters of more demonstrable kind than those employed in the literature. It has been the endeavor, therefore, to find and figure characters of such definiteness that anyone with even fair training in close work can be certain of the species he is trying to identify.

The first report upon this work was given under the title, "The Male Genitalia as Characters of Specific Value in Certain Cryptocerata," which appeared in volume XI of the KANSAS UNIVERSITY SCIENCE BULLETIN, December, 1919. In this the writer called attention to these characters in the Naucoridæ, Saldidæ (not a cryptocerate, of course), Gelastocoridæ, Corixidæ and Notonectidæ. The treatment of the genus *Notonecta* was sufficiently complete to be of value to the systematist, because the male genital capsules of all the North American species were figured or described, save two, *N. uhleri* Kirk. and *N. montezuma* Kirk., the former readily recognizable by the description, and the latter exceedingly rare, represented, so far as indicated in the literature, by two specimens in the Hope museum, carefully studied and figured by Champion. (Figure 8, plate XXXI, Science Bulletin XI, figures *Notonecta howardii* Bueno, and fig. 5, plate XXXI, Science Bulletin XI, figures *Notonecta shooterii* Uhl. The one there named *N. lutea* is, of course, *N. borealis* Hussey and Bueno.)

Studies were made upon the Nepidæ and Corixidæ, but were not reported in the first paper, and there was no intention, until recently, of publishing upon the Nepidæ. However, four species of *Ranatra* have been taken in Kansas waters as a result of recent collecting, all new records for the state. The task of naming these water scorpions involves problems in nomenclature and the authenticity of species—matters concerning which there is a difference of opinion among our best authorities.

Mr. J. R. de la Torre Bueno has believed that *Ranatra nigra* Herrich Schäffer 1853, is a synonym of *Ranatra fusca* Palisot Beauvois 1805. The insect which he calls *Ranatra fusca* is large with very prominent eyes, slender anterior legs, and a deep, broad prosternal groove—a very characteristic insect. With this interpretation of

Palisot's species, he described a small, compactly built insect with very broad front femora, as *Ranatra kirkaldyi.*

Dr. A. L. Montandon (Bul. Soc. Sci. Bucharest, XIX, 1910) considers *Ranatra kirkaldyi* Bueno a synonym of *Ranatra fusca* P. B., and concludes that *Ranatra nigra* H. S. is a good species, although he has seen no American specimen that fits the description. Van Duzee follows Montandon.

In a recent issue of the Entomological News (vol. XXXII, p. 273, 1921), under the title "New Records of Aquatic Hemiptera for the United States with Description of New Species," Mr. Torre Bueno again defends his *Ranatra kirkaldyi* and comments on *Ranatra fusca* P. B., describing it so closely that there can be no mistaking the insect, and stating that there is a specimen of this species in the United States National Museum labeled *Ranatra fusca* P. B., by Doctor Montandon. This statement is indeed true.

Through the kindness of Dr. L. O. Howard, Doctor Aldrich and W. L. McAtee, the writer had the pleasure of spending some time at the United States National Museum studying the aquatic Hemiptera. He had the opportunity, therefore, of examining the material determined by Doctor Montandon, as well as the types of *Ranatra protensa* Montd., *Ranatra brevicollis* Montd. and *Curicta howardii* Montd. He found two distinct species identified by Doctor Montandon as *R. fusca* P. B. One of them is Bueno's *Ranatra fusca;* the other, quite a different species, but not Bueno's *R. kirkaldyi.*

After examining much material in the family Nepidæ, and very carefully studying and weighing original descriptions and comparative notes, the writer has been forced, in spite of his reluctance, to a new interpretation of the old species. The facts which led to the change in nomenclature are presented under the species concerned. All the species are figured in such detail that there need be no question or uncertainty as to designation, and these studies should aid in arriving at a solution of the matters in controversy.

The family Nepidæ is represented in America, north of Mexico, by three genera, *Nepa, Curicta* and *Ranatra,* which may be separated as follows:

A. Body broadly oval and flat. *Nepa.*

AA. Body elongate.

B. Prothorax a little broader than head, body elongate oval. *Curicta.*

BB. Prothorax narrower than head, body very elongate. *Ranatra.*

Genus *Nepa,* see p. 428; genus *Curicata,* see p. 429; genus *Ranatra,* see p. 433.

GENUS NEPA Linnæus 1758.

We have one species in the genus *Nepa: N. apiculata* Uhl.

Nepa apiculata Uhler.

Uhler, P. R., in T. W. Harris' Insects Injurious to Vegetation, 3d ed., p. 12, plate 1, fig. 1; 1862.

This species was first made known to science through a picture of it which appeared in the third edition of Harris' "Insects Injurious to Vegetation." In this edition Doctor Uhler added notes on the Hemiptera. Then in 1878, Uhler, in his "Notices of the Hemiptera Heteroptera in the Collection of the Late T. W. Harris" (Proceedings of the Boston Society of Natural History, vol. XIX, Pt. IV, 1878), records the presence of "No. 26, Harris Collection, *Nepa apiculata* Say MS., under stones near water, May 15, 1826," and adds the following descriptive note: "The principal differences between our species and the European one consist in the color of the tergum, which is red in the latter, fuscous in ours; and the length of the apical tubes, which in ours are stouter and shorter." In commenting on these comparisons, Montandon (Bul. Soc. Sci. Bucharest, VIII, 1898) says that Uhler, like Stal and Ferrari, attached too much importance to color, and gives illustrations of the variability of *Nepa apiculata* Uhl. and of *Nepa cinerea* L. to prove the danger of considering color of specific significance. He then states that the American species is a little more transverse across the thorax, the abdomen proportionately larger in the rear, and the respiratory tubes shorter than in the European species. Again in volume XVIII of the same periodical, under the title, "Hydrocorises de l'Amerique du Nord, Notes et Descriptions d'Espèces Nouvelles," Doctor Montandon adds that in "*Nepa apiculata* Harris 1862, Uhler 1847,* . . . the superior part of the head is less boldly carinate, especially on the vertex, which is generally almost smooth, quite feebly convex."

These differences between the European *Nepa cinerea* L. and the American *Nepa apiculata* Uhl. do exist, as an examination of the photographs on plate LI will show. However, without both species for study, one would be compelled to remain in doubt or name the species from its geographical distribution. Since there do occur marked structural differences, it is well to note them. The antennæ, for instance, are very different, as an examination of figures 5 and

*Probably a typographical error, because Uhler was born in 1835. Van Duzee omits the reference: Montandon, Bul. Soc. Sci. Bucharest, XVIII, p. 180, from the list under *Nepa apiculata* Uhl. in his catalogue of 1917. It is interesting to note that *Nepa apiculata* was a Say manuscript species.

6, on plate XLVII, will show. The penultimate segment of the European form has a lateral prolongation which gives the antenna a branched appearance. The *Nepa apiculata* lacks this entirely. The male genital capsules are also unlike. The considerable difference between these and between the claspers is indicated on plate XLVII, figures 1, 2, 3 and 4.

The nearest approach to a formal description of the American species is given by Uhler in the Riverside Natural History, vol. II, p. 253, 1884. It follows:

> Color dull fuscous gray, with the base of the abdomen above more or less tinged with reddish. It is of an elliptical form, blunt in front, with a ridged middle line on the vertex, and with three short raised lines on the prothorax, each side of a longer one on the middle. The surface and margins of the thorax and head are roughly granulated, while these, together with the scutellum and corium, are rough and closely covered with stiff, short pile. The anterior femora have no teeth on the inner angle, but instead there is a prominent elbow, forming a wide expansion for the sides of the deep gutter. The wings are smoke brown, with darker veins. This species closely resembles the European one, and measures about two-thirds of an inch to the end of the abdomen; while the respiratory tubes are a little more than one-fourth of an inch in length.

Montandon has shown the differences between our species and the European *N. Cinerea* Linn.

The United States National Museum has specimens from Massachusetts, Pennsylvania, Maryland and Illinois. I have seen specimens from New York, Minnesota and Wisconsin.

GENUS CURICTA Stal, 1861.

These insects are very interesting because they are intermediate between the broad, flat *Nepa* and the very slender *Ranatra*. The Americas can boast of several species in this genus, but for North America, north of Mexico, there has previously been recorded only one, and of it but a single specimen, taken at Victoria, Tex., just within our limits. From this specimen Doctor Montandon drew up the description of *Curicta howardii*. It is a pleasure, therefore, to record the capture of other specimens of this species and to add a second species which has not been described. This second species has been the subject of life-history studies by Mrs. Grace Wiley, and is reported further on in this bulletin.

KEY TO SPECIES.

A. Lateral prolongation of penultimate segment of antenna very short (see fig. 8, pl. XLVII). *C. howardii* Montd.

AA. Lateral prolongation of penultimate segment of antenna very long (see fig. 7, pl. XLVII). *C. drakei* sp. new.

Curicta howardii Montandon, 1910.

Montandon, A. L., Bul. Soc. Sci. Bucharest, XVIII, p. 181; 1910.

The original description is in French. The writer's free translation follows:

Elongate oval in form, visibly attenuate in front and rear, lateral margins not subparallel, the greatest width toward the posterior third. Head quite enlarged, although a little narrower than the front part of the pronotum, as long as wide, including the eyes, longitudinally carinate throughout its length, the carina more obtuse on the posterior interocular portion. Interocular space more than three times as wide as the diameter of the eye. Eyes small, globular, anterior part of head triangular, exceeding the anterior level of the eyes by a length equal to its width between the eyes in front.

Pronotum distinctly longer than its width behind, lateral edges subparallel on their anterior three-fifths, quite strongly widened on their posterior two-fifths; with four obtuse longitudinal carinæ, little accentuated and subparallel, two each side of the anterior part, the posterior part with two oblique carinæ arising from the anterior median carina and quite divergent behind. The anterior depression of the pronotum broadly semicircular, the anterior angles quite narrowed, subacute.

Scutellum with three longitudinal carinæ, the median continuing quite plainly clear to the apex of the scutellum. The two laterals slightly diverging behind, vanishing on the middle of the sides of the scutellum, which are slightly sinuate before the tip or end.

Coria insensibly and gradually widened behind on their basal halves, attaining their greatest width behind the middle and narrowing thereafter; membrane well developed, regularly subrounded at the extremity. Commissure of the clavus almost twice as long as the scutellum.

Appendages short, quite robust toward the base, attenuated thereafter, about half the length of the abdomen.

Anterior femora quite robust, as long as the pronotum on its lateral edges, with a single median tooth easily visible on the inner edge of the groove where the folded-up tibia is lodged, this tooth distinctly closer to the base than to the apex of the femur; the external side of the groove also appears denticulate, as if notched on the basal third of the femur. Neither teeth nor sinuosities toward the apex of the femur.

Anterior coxæ half the length of their femora. Anterior tibia quite long, blackish, with a pale annulation toward the base, and the apical third likewise pale; the extremity of the tarsi come to the basal third of the femora when the tibia is folded back against the latter.

Intermediate and posterior legs short, the ends of the posterior femora, which are a little shorter than their tibiæ, do not reach the suture of the last abdominal segment. Intermediate and posterior tarsi with their claws less than half as long as their tibiæ.

Median longitudinal part of the prosternum slightly saddle-shaped, projecting in all its width, more elevated than the lateral pieces, a little flattened and traversed its whole length by a fine median groove; very obtusely tuberculate in its anterior part. A greater space between the intermediate coxæ than between the anterior or posterior coxæ.

Length, 19 mm.; maximum width a little behind the middle of the corium,

4.5 mm.; at base of pronotum, 3.8 mm.; length of appendages, 7.7 mm., Victoria, Tex. A single specimen, United States National Museum, Washington.

To the above description Doctor Montandon adds the following helpful comparative notes:

This species is intermediate in size between *C. volxemi* Montd. and *C. scorpio* Stal (=*montandoni* Martin). It differs from *C. volxemi* Montd. by the pronotum being sensibly narrowed in front, while in the latter it is almost as wide in front as behind. In this character it approaches more closely to *C. scorpio* Stal, which also has the pronotum quite narrowed in front, with the same right-angled anterior angles almost sharp, but its anterior tibiæ are, however, slightly more elongated than in this latter species; that is to say, much more than in *C. volxemi* Montd. In the character of the median tooth of the anterior femur being situated closer to the base than the extremity, however, the species approaches *C. scorpio* Stal, but it is plainly separated from the latter by its head being longitudinally carinate throughout its entire length, while the head is simply convex between the eyes in *C. scorpio* Stal and almost plain in *C. volxemi* Montd.

Furthermore, in *C. scorpio* the scutellum is not carinate; the longitudinal grooves of the pronotum are also much less emphasized and the anterior tibiæ are more largely pale, darker only toward the base.

This is the first species of the genus found in the United States. It is to be presumed, however, that others may occur in the Southern states neighboring to Mexico, where are found the two species to which I have just compared it.

I take pleasure in dedicating this to Mr. L. O. Howard, as an indeed feeble expression of my sincere gratitude.

In the collection of Prof. H. G. Barber are three males from Huachuca mountains, Arizona, taken in 1899. They have been compared with the type in the United States National Museum by Dr. Carl Drake, through the kindness of whom I have been privileged to study the structural details of these interesting insects. The United States National Museum has a specimen taken by D. C. Van Dine at Camp Travis, Tex., March 30, 1918.

The species is a compactly built creature. The head is set deeply into the prothorax, the anterior lateral lobes of which are conspicuously swollen and incurved on their anterior tips to embrace a portion of the eyes. The front of the head appears almost truncate, due to the tylus and juga being about equal. The antennæ are small and the lateral prolongation of the penultimate segment short (see fig. 8, pl. XLVII). The pronotum has a broad, prominent elevation throughout its length. On the anterior half of this there is a median longitudinal depression. The genital capsule and its claspers are somewhat different from those of the species described below (see figs. 7 and 8, pl. XLV), but the specific differences are not great.

Curicta drakei sp. new.

Size. Length from 16 mm., in case of smallest male, to 22 mm., in largest female—not counting the respiratory filaments, which are from 7 to 8 mm. long. The width of the head, including the eyes, from 2 mm. to 2.25 mm.; the greatest width of anterior part of thorax, 2.5 mm. to 2.8 mm.; the greatest width of posterior portion of thorax, 3 mm. to 4 mm.; the greatest width of abdomen, 3.6 mm. to 4.75 mm.; the length of pronotum measured along the dorsal median line, 3 mm. to 3.6 mm.

Color. Obscured by incrustations, which color it from gray to black. The cleaned insect is yellowish to dark testaceous, the dorsum of abdomen red.

Shape. Relatively slender; greatest width of thorax is to length of body approximately as 1 is to 5.4. Sides of thorax and abdomen nearly parallel.

Structural characteristics. The head wider across the eyes than distance from caudal margin of head to tip of lora. The length before the eyes greater than that behind them. Eyes small, globular. Tylus longer than juga. The head longitudinally carinate.

Penultimate segment of antennæ with long, slender lateral prolongation (see fig. 7, pl. XLVII). The pronotum with anterior lateral lobes not greatly swollen; the lateral margins, therefore, not greatly curved. Three longitudinal grooves on disc of pronotum, the median one broad and straight, dividing the median longitudinal elevation into two parallel carinæ, laterad of which are the deep lunate grooves terminating caudolaterally in deep depressions. The posterior enlarged portion of pronotum bears four more or less distinct longitudinal carinæ, which in some specimens appear to arise as bifurcations of the two prominent carinæ before them, and again as independent elevations. Scutellum tricarinate, the median carina more prominent on posterior half, the lateral carinæ slightly curved and terminating about the middle of the lateral margins of the scutellum, these elevations and declivities often accentuated or obscured by incrustations. Membrane of wings well developed, as long as the elytral suture, reticulate, the apex of the wing covering the basal two-fifths of the genital segment. Operculum of male genital segment semicylindrical and slightly constricted before the apex, which is bluntly pointed and faintly carinate. The metasternal plate short, caudal margin nearly straight, the posterolateral prolongations attaining less than half the length of the coxæ and exposing a large elevated area (as long as wide) of sternite behind it. Front coxa and femur stout, coxa one-half length of femur, which bears its rather well-developed tooth nearer the base than the apex. This tooth is located on the inner edge, two-fifths of the distance from the trochanter to the apex of the femur. Tibia one-half as long as femur, the apex of the short tarsal segment barely attaining the middle of the tooth when tibia is flexed. Mesothoracic femur one-fourth longer than the tibia, which is two and one-half times as long as the tarsus without the claws. Metathoracic femur and tibia of equal length, the tibia about three and one-half times the length of tarsus without the claws, which are one-third the length of the tarsus.

Notes. The above species is described from a series of 20 specimens, 16 of which were collected by Mrs. Grace Wiley in Colorado

county, Texas. Three were taken in New Orleans, La., and belong to Dr. Carl Drake; and one from the state of Coloma, Mexico, is in the United States National Museum. The species is named in honor of Dr. Carl Drake, who believed the species to be new as long ago as 1916, but who never found time to study the matter thoroughly.

Curicta drakei, while measuring as long as *C. howardii,* is a much more slender species, and appears smaller. Indeed, comparing the males of the two species, there is a considerable difference in size and shape. The anterior lateral lobes of the pronotum are much more prominent in *C. howardii,* the sides of prothorax, therefore, more curved. The median longitudinal fossa in *C. howardii* is confined to anterior part of the median elevation. The tylus is longer in *C. drakei,* the antennæ are differently formed (see figures 7 and 8 on plate XLVII), and the metasternal plate is smaller. This new species differs from *C. volxemi* Montd. from Mexico by its smaller size (*C. volxemi* is 24½ mm. long without appendages), by the tooth on the front femur being conspicuously nearer base than apex, while Doctor Montandon's figure of his species shows the tooth in the middle, or nearer the apex. It further differs from *C. volxemi* by having the head longitudinally carinate and the scutellum tricarinate. The thorax is relatively shorter than in *C. volxemi,* which has a thorax twice as long as wide. The front coxæ of *C. drakei* are much shorter.

It differs from *C. scorpio* Stal, which, according to Montandon, lacks the carina on head and scutellum and has the sides of the thorax much as in *C. howardii* Montd. The longitudinal grooves of the thorax of *C. scorpio* Stal are less emphasized than in *C. howardii,* which in turn has them less emphazised than *C. drakei.* All of these points separate *C. drakei* from *C. scorpio* Stal, and are based upon Doctor Montandon's remarks upon the latter species. Champion, in his "Biologia Centrali Americana," places *Nepoidea montandoni* Martin as a synonym of *C. scorpio* Stal. Joanny Martin, under the title "Descriptions d'Espèces Nouvelles de Nepidæ (Hem.)," in Bulletin de la Société Entomologique de France, 1898, pages 66-68, describes on page 68 his *N. montandoni,* and figures the head and thorax on the previous page. *C. drakei* is unlike this species. Stal's description of *C. scorpio* is wholly inadequate.

GENUS RANATRA Fabricius 1790.

This genus is characterized by its very elongate, slender form. It is the dominant genus of the family Nepidæ in North America. Doctor Horvath, in his paper, "Les Relations entre les Faunes

Hémiptérologiques de l'Europe et de l'Amérique du Nord" (Proceedings of the Seventh International Zoölogical Congress, 1907), lists the genus *Ranatra* as belonging to the oriental fauna. Since that time Doctor Montandon has added several names to our American lists.

The species in the genus are superficially so similar in color and general characteristics that there has been much confusion in naming them. The descriptions have been made in several cases from a single specimen, without, therefore, a consideration of variations within the species. They have dealt with comparisons that can be appreciated only after long familiarity with the insects, and on this account many errors of determination have arisen. The most unfortunate circumstances attending the study of North American *Ranatra* has been the failure to recognize the identity of *Ranatra fusca* P. B. 1805 and *Ranatra nigra* H. S. 1853, the descriptions of which are inadequate, and therefore, since the types are not available, can be interpreted authoritatively only through the examination of abundant and representative material from the entire country.

After studying long series of specimens representing a wide distribution, the writer has been compelled by the evidence before him to place a new interpretation upon our North American *Ranatra*. This he has been reluctant to do, because it involves the renaming of our commonest two species. Stability, however, can never be attained in this group by postponing or ignoring the evidence that eventually must prevail.

Ranatra fusca P. B. was described and figured in color, natural size, by Palisot de Beauvois, in his "Insectes recueillis en Afrique et in Amérique, dans les Royaumes d'Oware et de Benin, a Saint Dominque et dans les États Unis, pendant les années 1786-1797."

The figure is not amplified nor enlarged as suggested by Doctor Montandon (Bulletin Soc. Sci. Bucharest, vol. XIX, 1910), who was in error in endeavoring to make *R. kirkaldyi* Bueno, our smallest North American *Ranatra*, fit a drawing that has the dimensions of our largest species. He was mistaken in believing *R. kirkaldyi* Bueno a synonym of *R. fusca* P. B., for there are two convincing reasons for believing *R. fusca* P. B. is represented natural size.

First. Palisot de Beauvois in his "Discours Préliminaire," page xv, says, "J'ai adopté, pour la grandeur des figures, un plan uniforme, et qui m'a semblé plus commode, c'est-à-dire celle d'un pouce pour tous les Insectes plus petits que cette mesure adoptée, en plac-

ant à côté une ligne perpendiculaire de la grandeur réel de l'animal. Ceux qui excèdent un ponce seront figurés de leur grandeur naturelle."

Second. The plate which bears the figure of *Ranatra fusca* has upon it three figures natural size (one of which is *Ranatra fusca*) and two figures enlarged. These two have the true length indicated by a line, and one of these, *Naucoris femorata,* of which the writer has specimens, fits the line which was drawn to indicate the true length. There are on the plate three figures of *Belostoma* which Palisot calls "*Nepa,*" male and female, of "*Nepa subspinosa,*" natural size, which are not accompanied by a "line of true length," and *Nepa minor,* accompanied by a line. The drawing of *Nepa minor* is as large as those of *Nepa subspinosa,* and yet the author distinctly says that *Nepa minor* is smaller. The line indicates its true length, and the inevitable conclusion is that the figure of *Ranatra fusca* is natural size. Indeed, a comparison of drawings with the specimens throughout the book shows the author consistently followed his stated policy of drawing large insects natural size and indicating enlargements by lines, whenever made.

Palisot's insects were taken between the years 1786 and 1797. Those from the United States, then, were taken from somewhere in the eastern United States, for the territories of the United States at that time were bounded on the north by Canada, on the west by the Mississippi river, and on the south by the north line of Florida. *Ranatra fusca,* therefore was collected within these limits.

Palisot, in his "Discours Preliminaire," alludes to an account of his travels as being in press. I have not located this, but have secured two brief biographical sketches of him; one from "La Grande Encyclopedie," vol. XXV, and the other more complete, from P. Larousse, "Dictionnaire du XIX Seicle 12," page 66. Neither of these mention a book of his travels. From these accounts we learn that he came to Philadelphia first in 1791 to secure assistance against a Negro uprising in San Domingo, where he was taking part in govermental affairs. He seems to have been in the United States for some time, for upon his return to San Domingo he narrowly escaped death at the hands of the blacks (1793). He escaped to Philadelphia without funds and supported himself there by giving lessons in music and language. Finally he secured help from France to make a scientific voyage in North America for new collections, and returned to his own country in 1798. He died in 1820. These brief facts indicate that most of his days in the United States were spent about Philadelphia, and it seems to me probable that many of his insects

were collected in that region. The possibility of his *R. fusca* not being known to us in nature seems to me quite remote.

According to the figure, *Ranatra fusca* of Palisot de Beauvois is a large, robust insect with broad anterior femora and short legs and respiratory tube. The question is, what insect of the range indicated has these characters? After careful consideration of the problem I must conclude that the only one with the proper size, robustness, broad femora and short legs is *Ranatra americana* Montd. It has the variable respiratory tube, usually longer than Palisot's figure, but not uncommonly as short, and in every case shorter than the body. The failure of the artist to indicate any apical tooth on the anterior femur is readily understood, since we know that this character is often obscured by a marginal fringe of pile so completely as to escape any but the closest scrutiny. It is indeed a somewhat variable structure; in some examples much reduced, and in others plainly visible. The writer has in his collection specimens which fit Palisot's figure almost exactly.

The second species with which we are concerned is *Ranatra nigra* H. S. This species was described in 1853 from America by Herrich Schäffer in his "Die Wanzenartigen Insecten." It was described as being from 2 to 2⅛ inches long from beak to tip of respiratory tubes, with the respiratory tubes not much over half as long as the body; indeed, he says they were three-fourths of an inch! Now the only species we have which in a series of specimens has a respiratory tube averaging three-fourths of an inch long is *R. protensa* Montd. Doctor Montandon described his *R. protensa* from a single large female, which, because of its very yellowish color and shorter limbs, did not suggest *R. nigra* to his mind. Indeed, considered alone, it is not at all to be expected that it would. *R. nigra* was described as having the structure of thorax and relative length of limbs as in *R. elongata*. Now, *R. elongata* has very elongate hind femora, the tips surpassing the last abdominal suture by a considerable distance. The length of limb in *R. protensa* Montd. is, on the whole, not as great as in *R. elongata*, but is strikingly longer than in *R. linearis* L., with which he compared it in size, and this suggested *R. elongata*. Indeed in many specimens of *R. protensa* Montd. the hind femora surpass the last abdominal suture. The front legs of *R. protensa* are long and very slender and the thorax is more like that of *R. elongata* than of *R. linearis*. Doctor Montandon said that he had never seen any specimens from North America with legs as in *elongata*. We have three species with limbs relatively as long.

It seems scarcely necessary to mention that the color implied by the name *nigra* has nothing to do with the case, for black coloration occurs in all the species, due to one of two causes—either dark incrustations or deposits upon the integument, or dark discoloration due to failure in drying out the specimens. Either of these causes might account for a uniform dark or black color in a given series of insects.

There are other facts relative to the identity of these species which will be presented under notes after the various descriptions, to which the reader is referred for further evidence. Aside from the points mentioned, the probability of our two commonest and widespread species being first described is of itself very great.

The list of the species of *Ranatra* now known from America north of Mexico is as follows:

Ranatra fusca P. B. 1805 = *Ranatra americana* Montd. 1910.

Ranatra nigra H. S. 1850 = *Ranatra protensa* Montd. 1910.

Ranatra quadridentata Stal 1861.

Ranatra kirkaldyi Bueno 1905 and its variety *hoffmanni*, n. var.

Ranatra brevicollis Montd. 1910.

Ranatra buenoi, sp. new = *Ranatra fusca* Bueno and Mondt. in part.

Ranatra drakei, sp. new.

Ranatra australis, sp. new.

It will be noted that *R. quadridentata* Stal, completely submerged in Van Duzee's catalogue under *R. americana* Montd., is restored. Dr. F. H. Snow, in Trans. Kan. Acad. Sci., vol. XX, pt. 1, p. 153, 1906, was not writing about the species which Doctor Montandon later described as *R. americana*, but another which we believe to be *R. quadridentata* Stal, and should not have been synonymized by Van Duzee. It will also be seen that *R. annulipes* Stal is omitted. This *R. annulipes* Stal is a very distinct species and not to be mistaken for any the writer knows from our range. Doctor Montandon has established, through the examination of types and type material, that *R. fabricii* Guér. is the same as *R. annulipes* Stal. Figures of this species are given in this paper, because it has been cited as coming from our range.

The variety, *edentata* Montd., of *R. americana* Montd., is assumed to be an *americana* with attenuated apical tooth on front femur. Whether it should be recognized as a variety is questionable.

The entire question of the correct names for the *Ranatra* was, as the writer has stated, opened by the necessity of naming four species

from Kansas. The problem was undertaken with no preconceived notions in the matter, except, indeed, a leaning toward accepting Doctor Montandon's studies, since he is a great scholar in the Cryptocerata and was followed by Van Duzee in his catalogue. The results herewith presented may be received with some irritation, because of the revolution necessary in nomenclature, but it seems best for us to get as near the truth as the evidence permits.

In an endeavor to fix the limits of the species, the writer has studied the characters used by the best systematists in the group and in addition, antennal and genital structures. The relative length of body parts, the comparative size of the eyes, the relative length of the limbs and of the caudal filaments, the shape of the sternum and the form of the front femora have been in general use in the attempts to define nature's species in this genus. Species are expected to vary within limits, and breeding experiments with insects show them to vary, not only in single characters, but in linked characters, and in order to steer a fair course between "lumping" and "splitting" species, it is much better to use a combination of three or more characters than to depend too much upon any single one. The use, therefore, of the characters of the antennæ and genitalia is a material aid in the classification of this difficult group.

NOTES ON TERMS USED IN KEYS AND DESCRIPTIONS.

The apical tooth of the front femur is on the inside edge of the front femur near the attachment of the tibia (see fig. 2-A, pl. XLIV). The antennæ are hidden in pockets beneath the eyes (see fig. 9, pl. XLV). The prothorax of *Ranatra* is divided into two parts, anterior and posterior, by transverse lateral grooves (see fig. 2-G, pl. XLIV). The tylus and jugæ are figured on plate XLV, figure 12. The metaxyphus extends back between the hind coxæ as a part of the metasternum. The last abdominal segment is designated as the "genital segment," and its ventral plate in both sexes as the "operculum."

In this paper I have not distinguished between the genital segment and the last abdominal segment, as is often done with some other Heteroptera, where the last abdominal segment is considered the segment just in front of the genital segment. I refer to this as the penultimate abdominal segment (see figs. 10 and 11, pl. XLV).

The male genital capsule of which I speak is, I take it, homologous with what G. C. Crampton in the Bulletin of the Brooklyn Entomological Society, volume XVII, pages 45-55, calls the hypandrium," and the claspers correspond to his "styli," or "gonostyles."

TECHNIQUE USED.

The antennæ are often covered with debris that should be removed. If the antennæ are still difficult to see, the specimen may be relaxed and antennæ moved into view with dissecting needle. The genital capsule of the male lies in the last abdominal segment, entirely hidden. To examine this, relax the specimen in a moist chamber, then holding the specimen on its right side in the left hand, lower the operculum with a dissecting needle and draw out the capsule. A needle with just the very tip turned at right angle is best to use. It can be inserted alongside the capsule, turned so that the hook is against the capsule, and slowly withdrawn, bringing with it the desired organ. If the respiratory filaments start to come also, loosen the capsule from them by inserting the needle between capsule and filaments on each side. The capsule may be removed entirely and mounted upon a card below the insect, or simply drawn into view. The insects are not in the least damaged, and the male capsules may be taken out and operculum pressed back into place by a careful person without it being detected by the closest examination of the exterior.

KEY TO THE SPECIES.

A. Antennæ simple, distal end of the penultimate segment without lateral prolongation. Front femora broad and stout and not narrowed near middle.

B. Front femora without apical tooth or marked sinuosity.
R. kirkaldyi Bueno.

BB. Front femora with apical tooth or a marked sinuosity.
R. kirkaldyi Bueno.
var. *hoffmanni,* new.

AA. Antennæ with distal end of penultimate segment with a lateral prolongation. Front femora somewhat narrowed in their middle section.

B. The lateral prolongation of the penultimate segment of antennæ not greater than one-half of the length of the ultimate segment. Front femora very slender and without apical tooth.

C. Prosternum with a single wide, deep longitudinal trough. Eyes very prominent. *R. buenoi,* sp. new.
(= *R. fusca* Bueno.)

CC. Prosternum without the deep trough, but possessing two longitudinal depressed lines characteristic of most species of *Ranatra.* *R. nigra* H. S.
(= *R. protensa* Montd.)

BB. The lateral prolongation of the penultimate segment of antennæ greater than one-half the length of the ultimate segment.

C. Sides of body (connexivum) embracing the operculum of the genital segment at its extremity (see fig. 11, pl. XLV),
R. annulipes Stal.
(= *R. fabricii* Guér.)

CC. Sides of body not embracing the genital operculum at its extremity (see fig. 10, pl. XLV).

D. Pronotum broad and short, anterior enlargement subequal in width to entire head. Anterior femur broad and stout without apical tooth. Median tooth half way between trochanter and tibial joint (measured on inner edge). Metaxyphus very long, extending beyond middle of hind coxæ, nearly attaining abdomen.
R. brevicollis Montd.

DD. Pronotum more slender. The median tooth of anterior femur nearer distal than proximal end. Metaxyphus not often extending beyond the middle of hind coxæ.

E. Front femur broad without apical tooth.

F. Jugæ of head more prominent than tylus.
R. australis, sp. new.

FF. Tylus fully as prominent as jugæ.
R. fusca P. B.
(var. *edentula* Montd.)

EE. Front femur with apical tooth.

F. Anterior portion of prothorax fully twice as long as thickened posterior portion. Eyes large, plainly greater than interocular space. Jugæ of head prominent. Front femur long and slender. Hind femur surpassing middle of penultimate abdominal segment. Caudal filaments as long as body. *R. drakei,* sp. new.

FF. Anterior portion of prothorax shorter than above. Eyes not much, if any, greater than interocular space. Jugæ not so prominent. Front femur fairly stout. Middle and hind femora short, not attaining middle of penultimate segment.

G. Eyes prominent, plainly transverse, fully as large as interocular space. Anterior part of pronotum somewhat flattened dorsoventrally. Hind femora short.
R. fusca P. B.
(= *R. americana* Montd.)

GG. Eyes not prominent, neither transverse nor as large as interocular space. Anterior part of pronotum more cylindrical.
R. quadridentata Stal.

Ranatra kirkaldyi Bueno.

Bueno, J. R. de la Torre, Can. Ent. XXXVII, p. 187, 1905.
(= *R. fusca* Montd., Bul. Soc. Sci. Bucharest, XIX, p. 3; 1910.)

Original description:

Abdominis dorsum orange brown; eyes small, not very prominent; prothorax much constricted at the middle, bisulcate beneath; wings smoky; anterior femora broad with a prominent tooth near the middle, otherwise smooth; posterior tarsi extending beyond the middle of the air tube; air tube shorter than the length of the abdomen; legs banded. Length from tip of abdomen to tip of rostrum, male, 23 mm. to 26.4 mm.; female, 27 to 31 mm.

Notes. This is the species that Doctor Montandon has considered a synonym of *R. fusca* P. B.* Its much smaller size (*R. fusca* P. B. measures 37 mm.) is not the only reason for believing otherwise. The anterior femora of *R. kirkaldyi* Bueno are not constricted near the middle tooth as they are in *R. fusca* P. B. The front legs and respiratory tube are both shorter relatively than in Palisot's figure. This is the smallest known species in North America. It is a characteristic species, quite unrelated and distinct from the others. In the first place, the antennæ are much reduced. They are straight, lacking any projections from the penultimate segment, and often lack anything more than a constriction to distinguish the terminal segment. The ultimate segment is sometimes fused with the penultimate (see figs. 9 and 11, pl. XLVII), but all stages of separation can be found. The male genital claspers are also very distinct, as shown by figure 5 on plate XLVI.

Specimens of this species taken by Beamer and Hungerford in Cherokee county, Kansas, were identified by Mr. J. R. de la Torre Bueno. They agree with the original description in lacking any apical tooth or sinuosity near the apex of the femora. They measure from tip of beak to base of filaments, from 24 to 30 mm., with the filaments from 14 to 17 mm. long. I have seen the true *R. kirkaldyi* Bueno from New York.

In addition to the above Kansas series, I have before me the following series of 127 specimens as follows:

8 Rockbridge, Ohio, 9-30-16, C. J. Drake.
1 Rocky Mount, N. C., 10-19-16, R. W. Leiby.
3 St. Paul, Minn., Phalen Lake, 6-19-21, H. B. Hungerford.
1 St. Paul, Minn., Lake Johanna, 6-26-21, H. B. Hungerford.
4 Ramsey county, Minnesota, 1-9 22, W. E. Hoffman.
7 St. Paul, Minn., Lake Johanna, 10-13-22, W. E. Hoffman.
9 St. Paul, Minn., Lake Johanna, 10-14-22, W. E. Hoffman.
32 St. Paul, Minn., Lake Johanna, W. E. Hoffman.
3 Lincoln, Neb., 1 male, 2 females, W. E. Hoffman.
39 St. Paul, Minn., Water Supply Canal, 10-18-21, W. E. Hoffman.
16 St. Paul, Minn., Lake Johanna, 9-24-21, W. E. Hoffman.
4 St. Paul, Minn., Lake Johanna, 9-17-21, W. E. Hoffman.

I have also seen a series of 170 taken by Doctor Drake in Ohio.

These Minnesota specimens have certain characteristics which set them clearly apart from the Kansas series, yet there can be no mistake in considering them as belonging to the same species. Since I have had a fairly good series of these insects, which are smaller

*See plate XLIX, figures 1 and 2.

than the Kansas forms, more robust, with front femur relatively thicker and possessing a more or less well-marked sinuosity near the inner apex, with antennæ which, on the whole, are blunter at tip, and the subapical tooth of the claspers of male slightly more slender, it seems wise to consider them a variety, for which I propose the name *Ranatra kirkaldyi* var. *hoffmanni*. It will be noted that Mr. W. E. Hoffman has provided me with the longest series of this variety. In a series as large as this, it would seem that if the variety were not fixed there should be found forms like the true *kirkaldyi*, which is described as having "anterior femora broad with a prominent tooth near the middle, otherwise smooth."

Ranatra buenoi, sp. new.

= *R. fusca* Bueno, Can. Ent. XXXVII, p. 188, 1905.
Bueno and Brimley, Ent. News, XVIII, p. 438, 1907.
Bueno, Ent. News, XXXII, p. 273, 1921.
Montandon; determination in U. S. National Museum.

Size. Length from tip of beak to tip of abdomen, 32 mm. to 38 mm.; caudal filaments, 22 mm. to 27 mm. long.

Color. From light to very dark fuscous; top of abdomen orange and black; middle and hind legs of lighter forms banded.

Shape. Long and slender, prothorax long and slender; eyes very prominent and large; limbs all very slender and very long; the under side of prothorax with a single broad and deep sulcus, which distinguishes this species from any of our other forms (see fig. 6, pl. XLVIII).

Structural peculiarities. The eyes very prominent, transverse diameter greater than the interocular space; tylus longer than jugæ and as prominent as these parts, which are of medium development; antennæ with the lateral prolongation of penultimate segment not more than half the length of ultimate; prothorax slender, the anterior portion measured on the median dorsal line, twice the length of the posterior swollen part (the well-marked long transverse lateral grooves used as dividing line); scutellum somewhat elevated and slender and the length of the abdomen is to pronotum as 2¼ is to 1; respiratory filaments surpassing front margin of scutellum when brought forward; claspers of male genital bulb very distinct; subapical tooth greatly reduced (see fig. 1, pl. XLVI); all the limbs strikingly long and slender, especially the anterior femora (see fig. 1, pl. XLVIII); no apical tooth on anterior femur, the other tooth much nearer the apex than the base, the basal part being at least 1½ times as long as the part lying before the tooth; the coxa two-thirds as long as the femur.

The middle and hind legs long, the distal ends of hind femora surpassing the last abdominal suture and often nearly attaining caudal end of genital segment, while the middle femora frequently attain or surpass the caudal margin of penultimate abdominal segment; the distal ends of middle and hind legs almost attaining tip of respiratory filaments; the relative lengths of femora to tibiæ are about as 16 is to 19 for the middle leg and as 16 is to 22 for hind leg. The tarsi are small relatively, a little less than one-sixth as long as their tibiæ.

Notes. Described from the following series:

Male holotype, Colorado county, Texas, June 24, 1922; Mrs. Grace Wiley, collector.

Female allotype, Colorado county, Texas, June 24, 1922; Mrs. Grace Wiley, collector.

Paratypes as follows:

2 ♀♀ Raleigh, N. C., July 10, 1902; F. Sherman, jr., collector.
♂ Mound, La., November 6, 1918.
♀ Aberdeen, Miss.; Dr. Carl Drake.
3 ♀♀ and 1♂ Leland, Miss., September 16, 1921; C. J. Drake.
♀ Creve Coeur Lake, Mo., May 15, 1911; J. F. Abbott.
♂ Dime Box, Tex., July 20, 1911; C. T. Atkinson, collector.
17 ♂♂ and 22 ♀♀ Gainesville, Fla., June 19, 1918; Carl Drake.

Holotype and allotype in University of Kansas museum; paratypes in collection of Dr. Carl Drake, J. R. de la Torre Bueno, and the author.

This species has been named for Mr. J. R. de la Torre Bueno, who pointed out its structural characters in 1905.* It has also been named by some workers *R. fusca* P. B., and by at least one *R. nigra* H. S. It is clearly impossible for it to be either. The error of considering it *R. fusca* P. B. has been due to the inadequate description of *R. fusca* P. B. and to the fact that the original text with illustration has not been accessible to many, if any, American students of this group. By taking Palisot de Beauvois' figure of his *R. fusca* and comparing it with the species above described, it will be seen at once that the species are not the same. The long, slender limbs, the great eyes, the long thorax, the relative position of the tooth on the front femur, and the relation in length between femora and tibiæ of the legs, preclude the possibility that Palisot's artist had *R. buenoi,* sp. new, before him. The front legs of *R. fusca* P. B. are stout, not exceedingly slender. The median tooth of front femur is nearer the middle than in *R. buenoi,* sp. new. The anterior part of prothorax is less than twice the swollen part. The middle femora and tibiæ are nearly the same length as they are in *R. americana* Montd., for instance, and not considerably different in length as in *R. buenoi.* The hind femora are considerably shorter relative to the abdomen in *R. fusca* P. B. The tarsus of *R. fusca* P. B. is larger, being one-fifth as long as its tibia and not one-sixth as in *R. buenoi* sp. new. In other words, its proportions fit another American species, but not *R. buenoi.*

This species is not *R. nigra* H. S., for *R. nigra* H. S. has uniformly short respiratory tube of three-fourths inch and measures

* See Can. Ento., vol. XXXVII, p. 188; 1905.

over all from tip of beak to end of filaments 2 to 2⅛ inches, while this species has a tube averaging a full inch and varies in size from 2⅛ to 2½ inches. The shape of the eyes as shown in Herrich-Schäffer's figure, is very different, and the size which he says is "not larger than *R. linearis,*" would at once eliminate it, for in *R. buenoi* they are very large, but not so large as in *R. elongata,* specimens of which I have seen.

For illustration of this species, see figures 1 and 2, plate XLVI; fig. 12, plate XLVII; figure 1, plate XLVIII; and figure 5, plate XLIX. This species, as Bueno has written, is southern in distribution. Besides the localities above cited, I have seen it from Waycross, Ga., taken by J. C. Bradley, U. S. N. M.

Ranatra nigra Herrich-Schäffer.

Herrich-Schäffer, G. A. W., Wanzenartigen Insecten, IX, p. 32; 1853.
(= *Ranatra protensa* Montd. and all subsequent writers.)

Original description:

R. nigra m. tab. 290, fig. L, 2 = 2⅛". Nigra, tubis respiratoribus longitudinem dimidiam corporis parum superantibus. Grösse fast von *R. linearis,* schwarzer, die Augen night grösser aber seitlich mehr vortretend, der Scheitel daher breiter. Bau des Thorax und Längenverhältnisse der Beine wie bei *R. elongata.* Aus Amerika.

In addition to the above, and in the discussion relative to the genus *Ranatra* and the species *R. elongata, R. filiformis, R. linearis, macrophthalma* and *R. nigra,* he gives notes of comparison which throw further light upon his species. He says *R. elongata* has the longest respiratory tube (1¾ inches) and *R. nigra* has the shortest (¾ inch). The color is darkest in *R. nigra,* "die Augen sind am grössten bei *macrophthalma,* am kleinsten bei *linearis,* am rundesten bei letzerer, am meisten die Quere gezogen bei *nigra.*" His statement of length, 2 to 2⅛ inches from tip of beak to tip of tube with "Athmungsröhren nicht viel über halb so lang als der Körper," indicate that he had a series of the insects.

Notes. The only species of our country which agrees in size and uniformly short length of respiratory tube with the description of *R. nigra* is the insect we know under the name *R. protensa* Montd. Doctor Montandon had before him a single large, fairly short-limbed female, which is his type deposited in the United States National Museum. This ♀ was collected by Wm. H. Ashmead on Long Island. The respiratory tube is shorter than the abdomen. The legs extended would surely reach the tip of the respiratory tube.

Ranatra nigra is quite common over our country everywhere I have collected. It is most unfortunate that it was described from

blackened specimens, for indeed it is our lightest-colored species, being of a yellowish color with a trace of green throughout. This species has very prominent mesocoxæ and metacoxæ, which are angular, having a slight tubercle on the inner side. The breast, or prothorax in front of the mesocoxal elevations, is constricted and small, making the coxal elevations very pronounced.

The United States National Museum possesses, besides the type, specimens from Virginia, West Virginia, Pennsylvania, Maryland, Arkansas and Florida.

I have before me a series of seventy-nine specimens from Doniphan county, Kansas, taken by Robert Guntert and W. J. Brown; ten from Douglas county, Kansas, and forty specimens taken by Mr. W. E. Hoffmann and myself from the following places in Minnesota: Lake Johanna, Phalen lake and Minnehaha creek, all near the twin cities. We have also taken it in other parts of the state. Careful study of ample material, well distributed, shows that by far the commonest size is, total length, two inches, with respiratory tube three-fourths inch! The length of hind femur relative to abdomen varies, sometimes attaining the front margin of the genital segment and sometimes falling somewhat short of this. The eyes are transverse and somewhat protuberant. The jugæ fit closely against the tylus. The lateral prolongation of the penultimate segment of the antennæ is less than half the ultimate. The front femora are very slender and coxæ long. On page 156 of the University of Kansas Science Bulletin, vol. XI, where I give an English translation of Doctor Montandon's description in French of *R. protensa*, I should have written, "Anterior femora quite slender, but scarcely a fifth longer than their coxæ," instead of "as long as"—a careless error.

Ranatra annulipes Stal.

Stal, Öf. Vet. Akad. Förh., XI, p. 241, 1854.

Original description:

R. annulipes: Flavotestacea; hemelytris fuscescente testaceis; pedibus obsolete fuscoannulatis; spiraculis nigrofuscis. Long. 30, lat. 3¾ millim.—Brasilia.

In 1861, under the title "Genera Nepidarum synoptice desposita," in his "Nova methodus familias quasdam Hemipterorum disponendi," "Ofversigt af Kongl. Vetenshaps akademiens förhandlingar, Arg. 18, 1861, No. 4, he gives a more satisfactory description:

Ranatra annulipes. Stal. Nepidæ, 1861, p. 9.

R. annulipes. Pallide testaceo-grisea, pedibus obsolete fusco variis; abdomine dorso sanguineo-fusco, lateribus griseo-flavescentibus, stigmatibus nigris,

dorso pellucentibus; fronte convexiuscula; alis levissime infuscatis; prosterno bisulcato; femoribus anticis pone medium intus unidentatis, extus ibidem at prope apicem inermibus, intermediis posticis subbrevioribus, his ad medium segmenti ultimi abdominis porrigendis; aidothecæ appendicibus corpori æquilongis. Long. 30 millim. Brasilea (Mus. Hohn.).

Ranatra annulipes Stal. Of. Vet. Ak. Förh., 1854, p. 241-1. Præcedentibus duabus affinis et cum iisdem divisionem forma metasterni distinctissimam, Americam habitantem formans. Secundum formam metasterni in divisiones quattuor distinctas, determinationem specierum facilitantes dividi potest *Ranatra* genus."

Doctor Montandon (Bul. Soc. Sci. Bucharest, XVIII, 1910), who has examined Guérin's type of *R. fabricii* (1857) pronounces it to be the same as *R. annulipes* Stal, 1854. Sagra's Historia fisica, politica y natural de la Isla de Cuba, volume VII (1857) is not available to many of our workers; therefore, Guerin-Méneville's description of *R. fabricii* follows:

Ranatra fusca tubo respiratorio corpore paulo longiore; pedibus anterioribus nigro-fuscis; corpore infra obscure ferrugineo. Larg. 35, Anch. 3 millim.

Notes. This species is distinguished from all our species by having the connexivum of the genital segment enlarged and extended ventrally at the caudal end embracing the distal portion of the genital operculum (see fig. 11, pl. XLV). I have never seen specimens of this species from the United States and Prof. H. G. Barber informs me that his record from Texas was on a mistaken identification. Mr. W. L. McAtee says the species appears to be common in Cuba.

Ranatra fusca Palisot Beauvois.

Palisot de Beauvois, A. M. F. J., Ins. Rec. Afr. Am., p. 235; 1805.
(= *R. Americana* Montd., 1910, and subsequent writers.)

Original description:

Ranatre brune. Brune-verdâtre; soies un peu plus courtes que le corps; ailes brunes-rougeâtres. (Fig. 1.)

Ranatra fusca. Viridi-fusca; setis corpore brevioribus; alis fusco-rubellis. (Fig. 1.) États-Unis d'Amérique.

Obs. Cette espèce diffère de celle d'Europe par sa couleur plus pâle, par les soies qui terminent l'abdomen, plus courtes que le corps, par les ailes et le dessus de l'abdomen d'un brun rougeâtre.

Notes. A photographic reproduction of Palisot's figure (natural size) is given on plate XLIX, figure 1. On a previous page I have stated the evidence to show that Palisot's illustration is natural size. Size alone shows that Palisot's species is not the same as *R. kirkaldyi* Bueno. It also eliminated *R. nigra* H. S. (= *R. protensa* Montd.). The short legs and stout front femora eliminate *R. fusca*

Bueno. Even after making due allowances for "artist's license," it is not conceivable that the careful artist illustrating Palisot's species could have been looking upon *R. fusca* Bueno. The eyes of *R. fusca* Bueno are strikingly large, the anterior femora very slender, and the middle and hind tibiæ much larger in proportion to their femora than in *Ranatra fusca* P. B.

Doctor Montandon (Bul. Soc. Sci. Bucharest, XIX, 1910), who also has examined Palisot's figure, says in effect regarding it: ". . . When one considers only the essential details for the characteristics of a form, such as the proportional length of the legs and appendages, one recognizes without difficulty its short and very robust anterior femora, its very little developed posterior legs, and its appendages shorter than the abdomen . . ."

He was led into error by assuming the figure to be a great enlargement of Bueno's *R. kirkaldyi,* which cannot be true according to the facts elsewhere presented in this paper. Doctor Montandon says that his *R. americana* is readily distinguished by the shape of the prothorax, and indeed he is correct. The posterior enlarged part is plump and then narrows to a slender neck, then widens again in front. Any student with much experience with American *Ranatra* will recognize this characteristic at once (see Palisot's figure reproduced on plate XLIX, figure 1). Compare it with the photographs of our other species. Palisot's insect was broad and large; our only species comparable to it is *R. americana,* which is as large, sometimes a trifle larger. The anterior portion of prothorax is about one and one-half times the swollen posterior portion; so it is in *R. americana* Montd. (in *R. fusca* Bueno [= *R. buenoi,* sp. new] the anterior part is about twice the posterior part). The legs are short; so with *R. americana* Montd. The large ratio of length of tarsus to the tibia, 1 to 5+ (in *R. fusca* Bueno, 1 to 6+), shows similarity; also the hind tibia is a little longer than the femur, but not as much as in *R. fusca* Bueno. The broad anterior femora agree with *R. americana,* but the apical tooth is not shown. This, however, is a character which all students of this group realize could be overlooked readily. Sometimes the space in front of the tooth is filled with debris, obscuring the tooth; sometimes the tooth itself is much reduced. Doctor Montandon has a specimen from Philadelphia and another from Texas which lack the tooth and which he designates under the name *R. americana* var. *edentula.* In many of the specimens the tooth, therefore, is not marked and must have been overlooked by Palisot's artist. The caudal filaments are comparatively

short in the figure; so they are in many specimens of *R. americana.* I possess examples with even shorter filaments. On the whole, I should say the average is longer, but not as long relatively as in *R. buenoi,* sp. new (= *R. fusca* Bueno), or in *R. drakei,* sp. new, or in *R. australis,* sp. new. It is most robust and, on the whole, our largest species. I have collected it in New York, Minnesota and Kansas in numbers, and have seen specimens from various other states.

Ranatra brevicollis Montandon.

Montandon, A. L., Bul. Soc. Sci. Bucharest, XVIII, p. 184; 1910.

Original description:

Ranatra brevicollis nov. sp. C'est bien à regret que je décris cette nouvelle forme sur un exemplaire malheureusement unique, assez peu dissemblable, au premier aspect de *R. quadridentata* Stal, mais ses caractères spécifiques ne premettent pas de la confondre avec les autres espèces *fusca* ou *quadridentata* dont elle diffère par ses fémures antérieurs très légèrement sinués vers leur extrémité. Elle a aussi une seule dent devant la sinuosité médiane de fémur. Un peu plus trapue, de forme moins allongée que *R. fusca* Pall. de B., ce qui pourrait la rapprocher de *R. quadridentata* Stal, elle se sépare aussi franchement de cette dernière par la forme du pronotum beaucoup plus court. En effet l'insecte a 34 mill. de longueur, sur lesquels la tête et le pronotum n'ont que 10 mill. Les appendices de 22 mill. sont sensiblement plus courts que l'abdomen. Les fémurs intermediaires et postérieurs courts, repliés en avant dépassent à peine la tête.

Le pronotum très robuste presque trois fois plus court que l'abdomen, assez fortement dilaté en avant et très fortement élargi en arrière, ne permet pas de la confondre avec *R. kirkaldyi* T. B. Il est en outre marqué de deux sillons longitudinaux un peu obliques sus les cotés, derrière la dilatation antérieure, n'atteignant pas en avrière les sillons transversaux qui limitent en avant la partie postérieure dilatée du pronotum. Cette dernière marquée d'une carène longitudinale médiane évanescente en arrière, mieux accentuée en avant où elle traverse les sillons transversaux qui limitent la partie postérieure dilatée.

Les pattes pas très grêles, un peu plus courtes proportionnellement que celles de *R. quadridentata* Stal; fémurs rougeâtres, marqués d' anneaux pâles, larges, peu visibles.

Metasternum en plaque, terminé au milieu en arrière par un prolongement rétréci entre les hanches postérieures, paraissant plus relevé que chez *R. fusca* P. de B. et *R. quadridentata* Stal, mais moins cependant que chez *R. fabricii* Guér. = *annulipes* Stal.

Cette espèce se distingue encore des trois autres formes connues de l'Amérique du Nord par l'opercule génital ♀ dépassant un peu sous la base des appendices. Le segment ventral qui précède l'opercule génital presque droit sur son faite longitudinal très peu convexe avant l'extrémité.

L'espace interoculaire convexe entre les yeux, mais sans trace de tubercule, à peine plus large qu'un œil. Les yeux très légèrement transversaux.

San Diego, Cal. Coll. Coquillett. U. S. N. M., Washington.

Notes. I have examined the type at the United States National Museum, the single example from which Doctor Montandon drew his description. It is a female. There is also a male with same data, that probably was taken with the type, and in addition there are two females from Eldorado county, California. One of them bears this note: "Fife of this insects were seen feeding on one grasshopper which got into the water." Another specimen, a female, from Lindsey, Cal., taken by C. Pemberton, is also in the National Museum. I have in my collection some specimens from Laguna Beach, Cal., taken by C. T. Dodds. To me the most striking character of *Ranatra brevicollis* is the apparently truncate head; the head does not appear broader than anterior part of pronotum, which is thick and short. The anterior lateral prolongation of the penultimate segment of the antenna is short, but little more than half the ultimate.

The salient characters, as assigned to this species by Doctor Montandon, are: Body thick-set, pronotum short, appendages shorter than abdomen, the legs not very slender, a little shorter proportionally than those of *R. quadridentata* Stal; metasternal plate with a middle prolongation between the posterior coxæ, more elevated than in *R. fusca* P. B. (= *R. buenoi*, sp. new), and *R. quadridentata* Stal, but less, however, than in *R. fabricii* Guér. = *annulipes* Stal. He says also that the genital opercule extends a little under the base of the appendages and the ventral segment which precedes the genital opercule almost straight on its longitudinal summit, very little convex before the extremity. I find, however, that the male operculum does not extend under the base of the appendages.

All of the insects of this species which I have seen came from California. (See fig. 2, pl. XLVIII; fig. 3, pl. XLV; fig. 14, pl. XLVII; fig. 3, pl. L.)

Ranatra australis, sp. new.

Size. Smallest specimen in our series measures 32 mm. from tip of beak to tip of abdomen with a respiratory tube 27 mm. long. The largest specimen is 37 mm. long with a tube 30 mm. long.

Shape. On the whole a slender species with a long prothorax and long hind femora.

Structural peculiarities. Eyes normal; jugæ very prominent, more elevated than tylus, a characteristic that distinguishes this species; antennæ with lateral prolongation of penultimate segment nearly as long as ultimate. Prothorax slender, sides fairly straight, the anterior portion measured on the median dorsal line two more or less times the posterior swollen part. Respiratory filaments quite long, a little less than length of the insect. The clasper

of the male genital capsule with the anteapical prolongation truncate and short and well separated from the apical. (See fig. 3, pl. XLVI.) Front femora broad without apical tooth. Hind femora surpassing the middle of the penultimate segment of the body and the hind tarsus reduced to one-sixth of its tibia. (See fig. 4, pl. XLVIII; fig. 1, pl. L; and fig. 15, pl. XLVII.)

Notes. Described from the following:

Holotype: Male, Colorado county, Texas, June 24, 1922; Mrs. Grace Wiley.

Allotype: Female, Colorado county, Texas, June 23, 1922; Mrs. Grace Wiley.

Paratypes: Five males and four females, Colorado county, Texas, June 23 and June 24, 1922; Mrs. Grace Wiley.

Nine males and three females, Gainesville, Fla., June, 1918; C. J. Drake.

One female, New Orleans, La., June, 1915.

One male, McComb, Miss., July 27, 1921.

One female, Fayette, Miss., July 23, 1921; C. J. Drake.

One male, Mound, La.,; J. C. Bradley (teneral specimen).

One male, Calyell, La., June 16, 1917; H. H. Knight.

One male, Kissimmee Lake, Florida; A. N. Resse.

Total of twenty-nine specimens from Texas, Florida, Mississippi and Louisiana. The last specimen, belonging to the U. S. National Museum, was labeled *R. fusca* by Doctor Montandon in 1909, and bears the following interesting note: "Alligator flea, water dog, said to bite or sting severely. Swamp east of Lake Kissimmee, Osceola county."

The holotype and allotype and two paratypes are in the University of Kansas collection; paratypes are also in the collection of Dr. C. J. Drake, Ames, Iowa; the United States National Museum, Washington, D. C.; J. R. de la Torre Bueno, and the collections of Mrs. Grace Wiley and of the author.

This species is smaller, slenderer and longer limbed than *R. fusca* (=*R. americana* Montd.). It differs also in the following particulars:

1. The jugæ more prominent than tylus—not true in *R. fusca* P. B.
2. The eyes are smaller than in *R. fusca* P. B.
3. The pronotum is longer; the anterior part two more or less, times the posterior part, whereas in *R. fusca* P. B. it is 1½ to 1½+.
4. The sides of prothorax more nearly parallel and posterior swollen part not so swollen.
5. The hind margin of pronotum roundly and broadly emarginate, whereas in *R. fusca* P. B. (=*R. americana* Montd.) the emargination is deeper and narrower.
6. The two depressions on the scutellum are deep and pitlike, while in *R. fusca* P. B. they are shallow and broad.

7. The hind femora longer, surpassing the middle of the penultimate body segment, often almost attaining its caudal margin. Femora not so developed in *R. fusca.*
8. Hind tarus of *R. australis* one-sixth or less of the tibia; one-fifth or less in *R. fusca* P. B.
9. Metaxyphus usually longer.
10. The female operculum angulate on its ventral line, while it slopes gradually and is longer in *R. fusca* P. B.
11. The respiratory filaments are relatively longer in *R. australis* sp. new, than in *R. fusca* P. B.
12. The front femora lack the apical tooth; *R. fusca* P. B. has one more or less marked.

Ranatra drakei, sp. new.

Size. Length from tip of beak to tip of abdomen 35 mm. to 46 mm.; in addition to this, the respiratory filaments are from 28 mm. to 44 mm. long.

Color. All the specimens in the series studied are yellowish brown with legs and tegmena overcast with an orange tinge.

Shape. A long, slender species with prominent eyes; long, slender prothorax; hind femora surpassing the middle of the last abdominal segment, and a very long respiratory tube.

Structural peculiarities. The eyes very prominent, transverse diameter greater than interocular space; jugæ prominent and divergent; antennæ with lateral prolongation of penultimate segment a little more than half the length of the ultimate segment; prothorax slender, the anterior portion measured on the median dorsal line 2½ times length of the posterior swollen part. The length of abdomen is to length of pronotum as 2¼ is to 1; the respiratory filaments long, as long as entire body in many of the specimens, greatly surpassing the limbs. The claspers of the male are shown on plate XLVI, figure 11. The limbs are long and slender; front femora slender, median tooth considerably nearer apex than base; distal tooth well marked and located at some distance away from the tibial joint, this distance being about one-fourth the length of that part of femur lying in front of the median tooth (see fig. 3, pl. XLVIII); middle and hind femora long; distal end of hind femora attaining, or nearly attaining, the caudal margin of the penultimate abdominal segment; the ratio between femora and tibia not quite but nearly as great as in *R. buenoi,* sp. new. See plate L, photograph 4 of paratype specimen.)

Notes. Described from eleven specimens, seven males and four females, taken at Gainesville, Fla., ten of them by Carl Drake, June, 1918, and one specimen taken March 18, 1915, collector unknown; holotype in collection of Carl Drake, allotype in University of Kansas collection, paratypes in the above collections and in that of the author.

This species has the general appearance of *R. buenoi,* due to the large eyes and elongate, slender body. It differs from that species, however, in the front femur possessing a well-defined apical tooth;

in more prominent jugæ; in differently formed antennæ; in its longer thorax; in the respiratory filaments greatly surpassing the limbs when extended backwards, and in the differently formed claspers of the genital capsule of the male. It cannot be confused with any other of our species.

Ranatra quadridentata Stal.

Stal, Öfversigt af Kongl. Vetenskaps akademiens förhandlingar, Arg. 18, 1861, No. 4, p. 204.

Original description:

Grisea, pedibus immaculatis; abdominis dorso sanguineo; oculis modice prominulis; thorace antice leviter ampliato, subtus bisulcato; alis levissime infuscatis; femoribus anticis subtus pone medium et prope apicem, licet hic obsolete, bidentatis, intermediis posticis vix aequilongis, his basim segmenti penultimi abdominis vix superantibus; metasterno ut in præcedente. Long. 33 to 36 millim. Mexico. (Mus. Holm.) Præcedenti affinis.

The "preceding" is *R. unidentata,* from Rio Janeiro, and concerning its metasternum he says,

"metasterno retrorsum fere ad apicem coxarum posticarum producto, segmentum ventrale primum tegente, uti videtur postice trilobato, lobis continuis, elongatis, medio convexo, lateralibus depressis, subarcuatis."

Notes. Van Duzee's catalogue completely submerges United States records of this species under *R. americana* Montd.* This is not justified, because Doctor Snow in his list (Trans. Kans. Acad. Sci., vol. XX, pt. 1, p. 153, 1906) was not writing about the insect that Doctor Montandon described as *R. americana.* I have before me Doctor Snow's insect from San Bernardino Ranch. Cochise county, Arizona, the same thing from Mexico, and a series from Texas. These insects agree splendidly with Doctor Montandon's comparative notes on Stal's species, cotypes of which he has studied carefully.

When Doctor Montandon described his *R. americana* (Bul. Soc. Sci. Bucharest, XIX, p. 65, 1910) he gave some remarkably clear notes of comparison between his species and Stal's *R. quadridentata.* The latter is not so robust, the eyes smaller, not so transverse, the interocular space not so convex; cheeks not so elongate, but not applied so closely against the tylus, which is shorter, making the head before the eyes appear shorter. The median construction of the pronotum is not nearly so marked and the anterior part more cylindrical. I may add that the anterior part of the prothorax is longer proportionally, the legs are longer and metaxyphus longer.

* Van Duzee's catalogue, *quadrinotato.* Doctor F. H. Snow published a list of the insects taken by him in Arizona, and listed *R. quadridentata* Stal as one of them.

SUMMARY.

The Nepidæ of North America north of Mexico now include a total of eleven species and two varieties, distributed as follows: one *Nepa,* two *Curicta,* and eight *Ranatra* species with two varieties. This count omits *R. annulipes* Stal, which probably does not occur in our range. The naming of our two commonest and widespread species, under the two oldest names given, is as conclusively shown as can be done without authentic types. We have decided that our large, robust, short-limbed form, with broad anterior femora, is *R. fusca* P. B., and that our slender-limbed form, with uniformly short respiratory filaments, is *R. nigra* H. S. This, most unfortunately, reduces to synonymy *R. americana* Montd. and *R. protensa* Mondt., names by which these species have been well known to us for the past ten years. The antennæ and genital claspers of the males have been of value—very striking and satisfactory characters in most of the species. The genital capsules themselves are of little value systematically in most of the *Ranatra.* The intromittent organ of the male has a more or less definite and characteristic shape at its tip (compare figures 6-I and 8-I, plate XLVI). Care has been taken to examine material from various localities in order to fix the limits of variation of these characters.

PLATE XLIV.

FIG. 1. Egg of *Ranatra fusca* P. B. (=*R. americana* Montd.) dissected from a water-soaked dead cat-tail blade.

FIG. 2. Diagrammatic drawing of *Ranatra*. *A*, apical tooth of front femur. *M*, median tooth of front femur. *C*, front coxa. *G*, prothoracic transverse grooves which separate the "anterior part of the pronotum" from the "swollen posterior part." *S*, scutellum.

FIGS. 3 AND 5. Stridulating device of *Ranatra*. Figure 5 shows ventral view of head and a portiòn of prothorax. The rubbing of the roughened patch (*A*) on the base of the coxa (*C*) against the file (*B*) on the inside edge of the anterior lateral margin of the prothorax (*P*) produces the chirping or squeaky noise. *D*, antennæ. Figure 3 gives an enlarged lateral view of base of coxa and anterior lateral margin of prothorax cleared so that the file shows through. Lettering same in both figures.

FIG. 4. *Ranatra* eggs in situ in soft, decaying cat-tail leaf, a portion of which has been removed to expose the eggs.

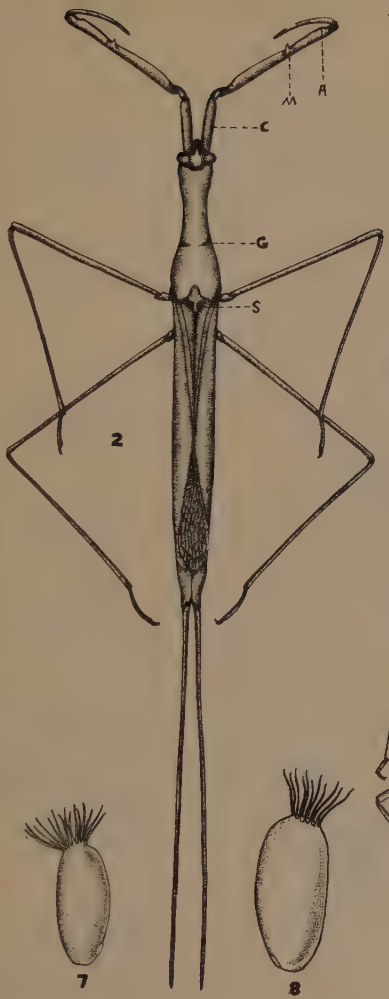
FIG. 6. Genus *Curicta*. Note that it is intermediate in shape between *Ranatra* and *Nepa*. Until the appearance of this bulletin only a single specimen was recorded from the United States.

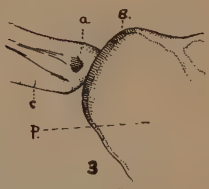
FIG. 7. Egg of *Curicta drakei*, sp. new, dissected from the tissues of a decaying plant stem, where only the crown of fifteen filaments was exposed. Drawing made from material secured by Mrs. Grace Wiley in her life history notes on this species.

FIG. 8. Egg of *Nepa apiculata* Uhl. Note the eleven filaments which remain exposed above the surface of the plant in which the eggs are inserted.

FIG. 9. Genus *Nepa*. Represented in the United States by a single species *Nepa apiculata* Uhl. This species varies considerably in size, but no constant structural detail has been found to indicate that the variants are not conspecific.

PLATE XLIV.





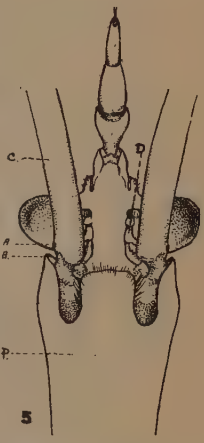


PLATE XLV.

FIG. 1. Clasper of male of *R. elongata* Fab., determined by Doctor Montandon. *S*, subapical tooth.

FIG. 2. Genital capsule of male of *R. elongata* Fab., determined by Doctor Montandon. Compare figures 1 and 2 with figures 3 and 4. Note the differences in shape of claspers, their relative lengths as shown in figures 2 and 4. The intromittent organ, *I*, is also often characteristic of a species, but not always, and subject to some variation. The capsule itself in *Ranatra* is of little value.

FIGS. 3 AND 4. Clasper and capsule of male *R. brevicollis* Montd. from California.

FIG. 5. Inside view of left clasper of *Curicta drakei*, sp. new. Compare with figure 8, *C. howardii* Montd. The shape of the clasper near the base is not the same in the two species.

FIG. 6. Male genital capsule of *C. drakei*, sp. new, viewed from right side.

FIG. 7. Male genital capsule of *C. howardii* Montd.

FIG. 8. Inside view of left clasper of *C. howardii* Montd.

FIG. 9. Ventral view of head of *Ranatra* to show the antennæ, which lie hidden. Sometimes they are covered with debris, which should be scraped away. It is often wise to relax the specimen and draw the antenna into a more exposed position. The front coxa also sometimes obscures the view and should be moved while specimen is relaxed.

FIG. 10. Lateral view of caudal end of abdomen and base of respiratory filaments of *Ranatra nigra* H. S. *C*, connexivum. *R*, respiratory filaments. *O*, operculum of genital segment, considered in this paper as last abdominal segment. *P*, considered in this paper as the penultimate abdominal segment.

FIG. 11. Lateral view of caudal end of abdomen and base of respiratory filaments of *Ranatra fabricii* Guér. from Cuba. Montandon says it is identical with *R. annulipes* Stal from Brazil.

FIG. 12. Dorsal view of head of *Ranatra*. *B*, beak. *J*, jugum. *T*, tylus.

PLATE XLV.

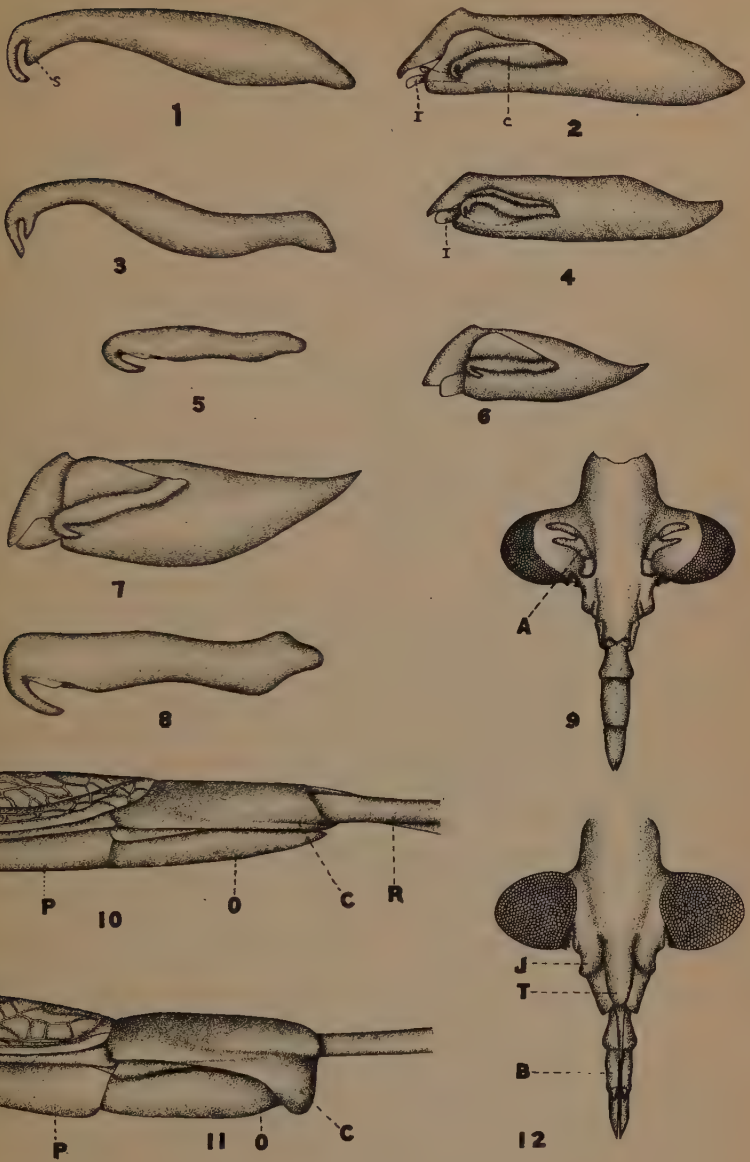


PLATE XLVI.

FIGS. 1 AND 2. Clasper and male genital capsule of *Ranatra buenoi*, sp. new. Note the reduced subapical tooth of the clasper and the spatulate form of the tip.

FIGS. 3 AND 4. *Ranatra australis*, sp. new. Note the truncate subapical tooth of the clasper and its distance from the apical one.

FIGS. 5 AND 6. *Ranatra kirkaldyi* Bueno. *S*, subapical tooth. *C*, clasper. *I*, intromittent organ. This species is clearly quite distinct in its relationship from the others. Note the shape of the intromittent organ and of the clasper.

FIGS. 7 AND 8. *Ranatra quadridentata* Stal. I am not able to find any constant differences between this and *R. fusca* P. B. (= *R. americana* Montd.) in respect to the male genitalia. The male of the latter species has, on the whole, a more slender clasper.

FIGS. 9 AND 10. *Ranatra brachyura* Horv., 1879, said to be same as *R. sordidula* Dohrn., 1860. From Japan. Confused by a student of this family with *R. protensa* Montd. and so labeled. Compare figures 9 and 13.

FIGS. 11 AND 12. *Ranatra drakei*, sp. new.

FIGS. 13 AND 14. *Ranatra nigra* H. S. (= *R. protensa* Montd.). The preceding species and this one have claspers which are broad in their middle parts, but the shape at the tip distinguishes them.

FIGS. 15 AND 16. *Ranatra linearis* Fab. From Europe. Berlese, in his Gli Insetti, p. 323, figures this species. Note that the difference between the clasper of this species and that of our American species is more apparent than the superficial appearance of the insects when side by side in the cabinet.

PLATE XLVI.

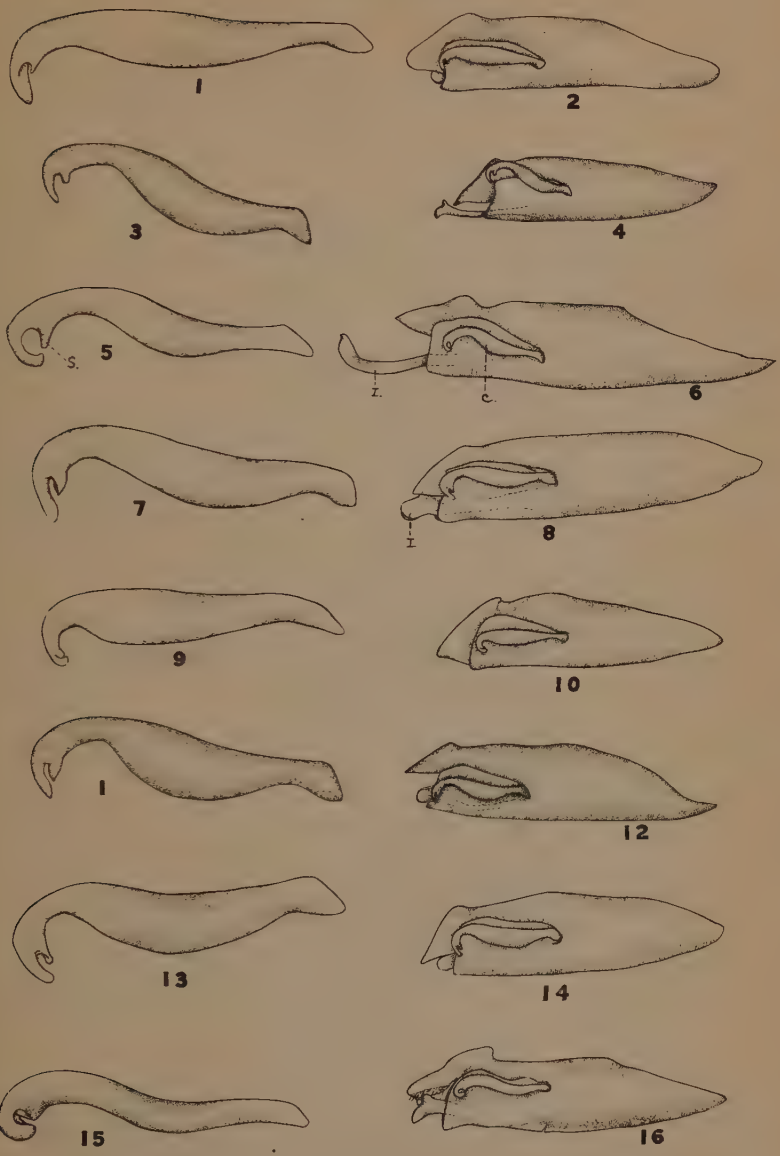


PLATE XLVII.

FIG. 1. Ventral view of male genital capsule of *Nepa apiculata* Uhler. From North America.

FIG. 2. Lateral view of clasper of above. Compare with figure 4 of *N. cinerea* L. of Europe.

FIG. 3. Ventral view of male genital capsule of *Nepa cinerea* L.

FIG. 4. Clasper, lateral view of *Nepa cinerea* L.

FIG. 5. Antenna of *Nepa apiculata* Uhler. From New York.

FIG. 6. Antenna of *Nepa cinerea* L. From Europe. *U*, ultimate antennal segment. *P*, penultimate antennal segment. *L*, lateral prolongation of penultimate segment. The splendid antennal and genital characters separating these two species of *Nepa* illustrate the taxonomic value of these hitherto unused structures in the Nepidæ. In the drawings which follow, do not attach significance to the basal segment, but to the last two segments.

FIG. 7. Antenna of *Curicta drakei*, sp. new.

FIG. 8. Antenna of *Curicta howardii* Montd.

FIGS. 9 AND 11. Antennæ of *Ranatra kirkaldyi* Bueno. Sometimes the ultimate segment is fused with the preceding segment and sometimes entirely separate.

FIG. 10. Antenna of *Ranatra nigra* H. S. (= *R. protensa* Montd.).

FIG. 12. Antenna of *Ranatra buenoi*, sp. new.

FIG. 13. Antenna of *Ranatra drakei*, sp. new.

FIG. 14. Antenna of *Ranatra brevicollis* Montd.

FIG. 15. Antenna of *Ranatra australis*, sp. new.

FIG. 16. Antenna of *Ranatra quadridentata* Stal.

FIG. 17. Antenna of *Ranatra fusca* P. B. (= *R. americana* Montd.).

PLATE XLVII.

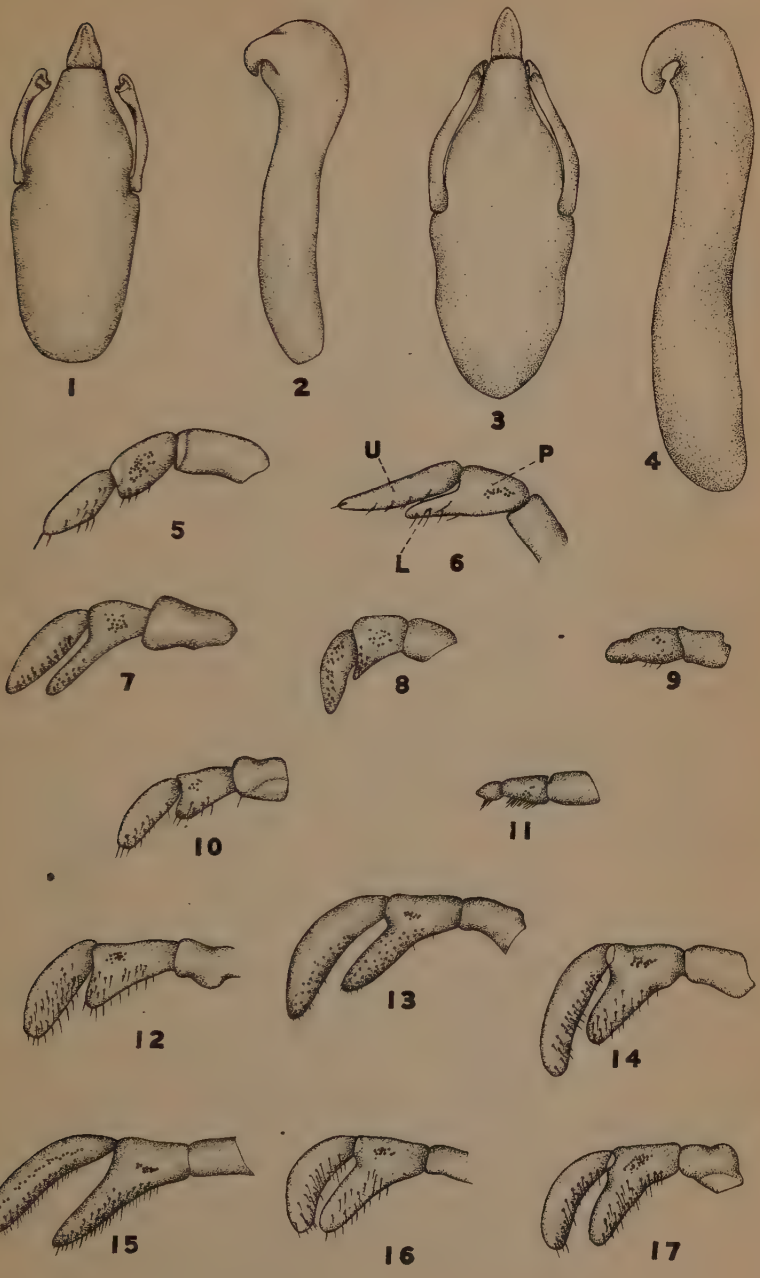


PLATE XLVIII.

FIG. 1. Front femur, tibia and tarsus of *Ranatra buenoi*, sp. new. Note its very slender form and the position of the median tooth.

FIG. 2. *Ranatra brevicollis* Montd. The median tooth is nearer the middle than in any of the others. The tibia is relatively longer.

FIG. 3. *Ranatra drakei*, sp. new. Note the slender form and the position of the apical tooth.

FIG. 4. *Ranatra australis*, sp. new. It lacks the apical tooth, and the anterior portion of the femur is not enlarged toward the distal end as in *R. fusca* P. B.

FIG. 5. *Ranatra fusca* P. B. (= R. *americana* Montd.). From Ithaca, N. Y.

FIG. 6. Ventral view of head and prothorax of *R. buenoi*, sp. new. To show the deep longitudinal trough. Compare with figure 10, which lacks it.

FIG. 7. *Ranatra kirkaldyi* Bueno. Note that the femur is not constricted in the region of the median tooth. Compare with *R. fusca* P. B., figure 5. This from Kansas.

FIG. 8. *Ranatra nigra* H. S. (= *R. protensa* Montd.)

FIG. 9. *Ranatra kirkaldyi* Bueno var. *hoffmanni* new. Apical tooth or marked sinuosity present. From Minnesota.

PLATE XLVIII.

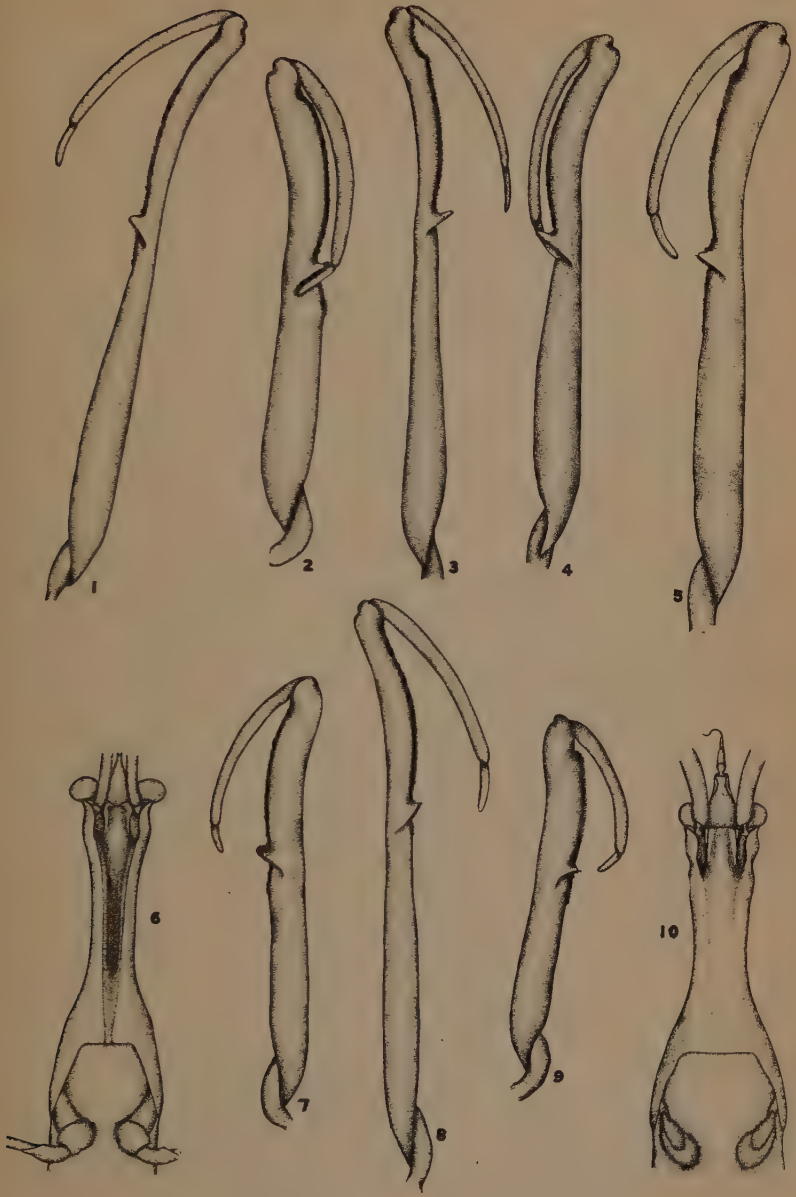


PLATE XLIX.

(All photographs natural size.)

PHOTO 1. Photograph of Palisot's figure of *Ranatra fusca,* reproduced exact size.

PHOTO 2. *Ranatra kirkaldyi* Bueno. Largest specimen in a long series. A female from Cherokee county, Kansas, determined by Mr. J. R. de la Torre Bueno. This is what Doctor Montandon has mistaken for *Ranatra fusca* P. B. Besides size, note shape of front femur. Not constricted as it is in figure 1.

PHOTO 3. *Ranatra fusca* P. B. (= R. *americana* Montd.) Note the general resemblance to original figure by Palisot (photo 1 above), the shape of the thorax, the broad anterior femora, the size of the insect, the reduced hind femora, etc. For other figures of this insect, see plate LI, photographs 3 and 7. Figure 7 is the only one to show the apical tooth of the front femur plainly. The writer has forms with the respiratory tube of various lengths. The shortest perfectly formed tube is shown on plate LI, figure 3.

PHOTO 4. *Ranatra kirkaldye* Bueno var. *hoffmanni,* var. new.

PHOTO 5. *Ranatra buenoi,* sp. new (= R. *fusca* Bueno). Compare with Palisot's *R. fusca* (photo 1). The relative proportions of the front femora, the length and shape of thorax, limbs and filaments. The long tibiæ and reduced tarsi. This photograph is of a paratype.

PLATE XLIX.

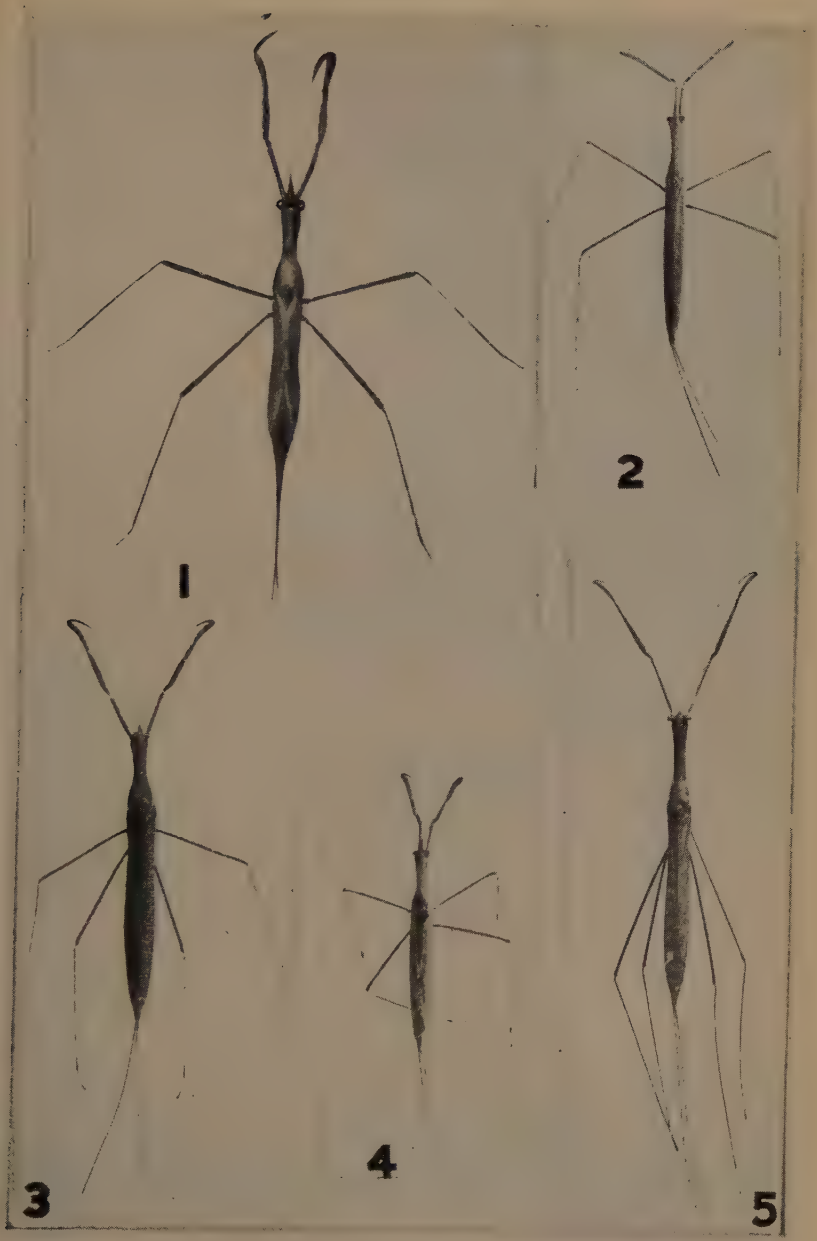


PLATE L.

(All photographs natural size.)

PHOTO 1. *Ranatra australis,* sp. new. Differs from *R. fusca* P. B. by shape of prothorax, longer respiratory tube, lack of apical tooth on front femora and by its elevated jugæ, as well as marked differences in the genital claspers of the male. Southern in distribution. Photograph from paratype.

PHOTO 2. *Ranatra nigra* H. S. (= R. *protensa* Montd.) This insect in a long series fits the original description most remarkably, except for the color, which is of no consequence at all: "Size 2-2⅛ inches from beak to tip of filaments. Filaments ¾ inch long; limbs long and slender." Photo 5 is another specimen—the latter from Minnesota, the former from Kansas.

PHOTO 3. *Ranatra brevicollis* Montd. From California. Note the short, broad thorax and its relation to the size of the head.

PHOTO 4. *Ranatra drakei,* sp. new. Slender front femora with apical tooth, large eyes, long thorax, long limbs, and very long respiratory filaments. (Photograph from paratype.)

PHOTO 5. *Ranatra nigra* H. S. (= R. *protensa* Montd.)

PLATE L.

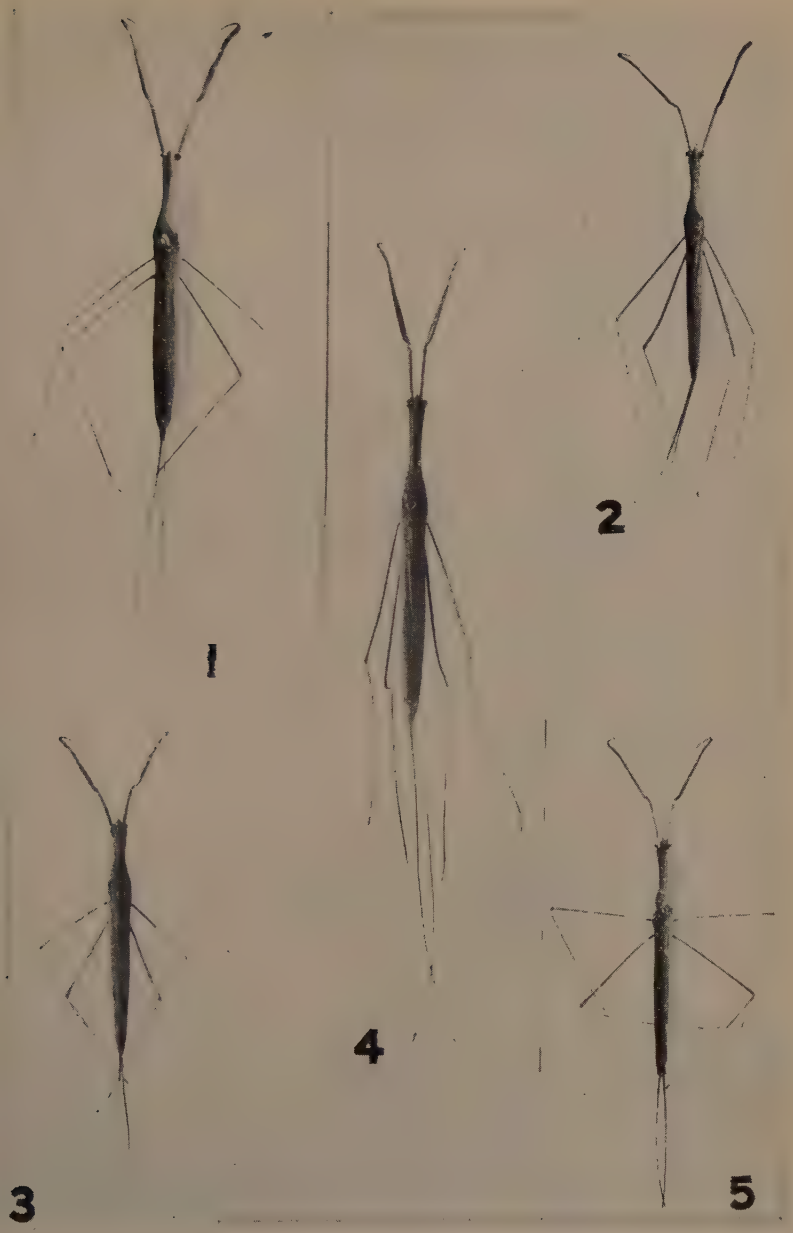


PLATE LI.

(All photographs natural size.)

PHOTO 1. *R. quadridentata* Stal. Small specimen taken by Doctor Snow in Arizona.

PHOTO 2. *Curicta howardii* Montd. Photograph from male belonging to Professor Barber. Compared with type at Washington by Doctor Drake.

PHOTO 3. *Ranatra fusca* P. B. Specimen from Minnesota with very short but perfectly formed respiratory filaments. The tips are normal.

PHOTO 4. *Curicta drakei,* sp. new. Male holotype.

PHOTO 5. *Nepa cinerea* L. Male from Europe. Compare with *Nepa apiculata* Uhl. from Minnesota, photo 8, then note structural differences figured on plate XLVII.

PHOTO 6. *Curicta drakei,* sp. new. Female allotype.

PHOTO 7. *Ranatra fusca* P. B. Shows how long the respiratory filaments may be and how marked the apical tooth of front femur.

PHOTO 8. *Nepa apiculata* Uhl. Female from Minnesota.

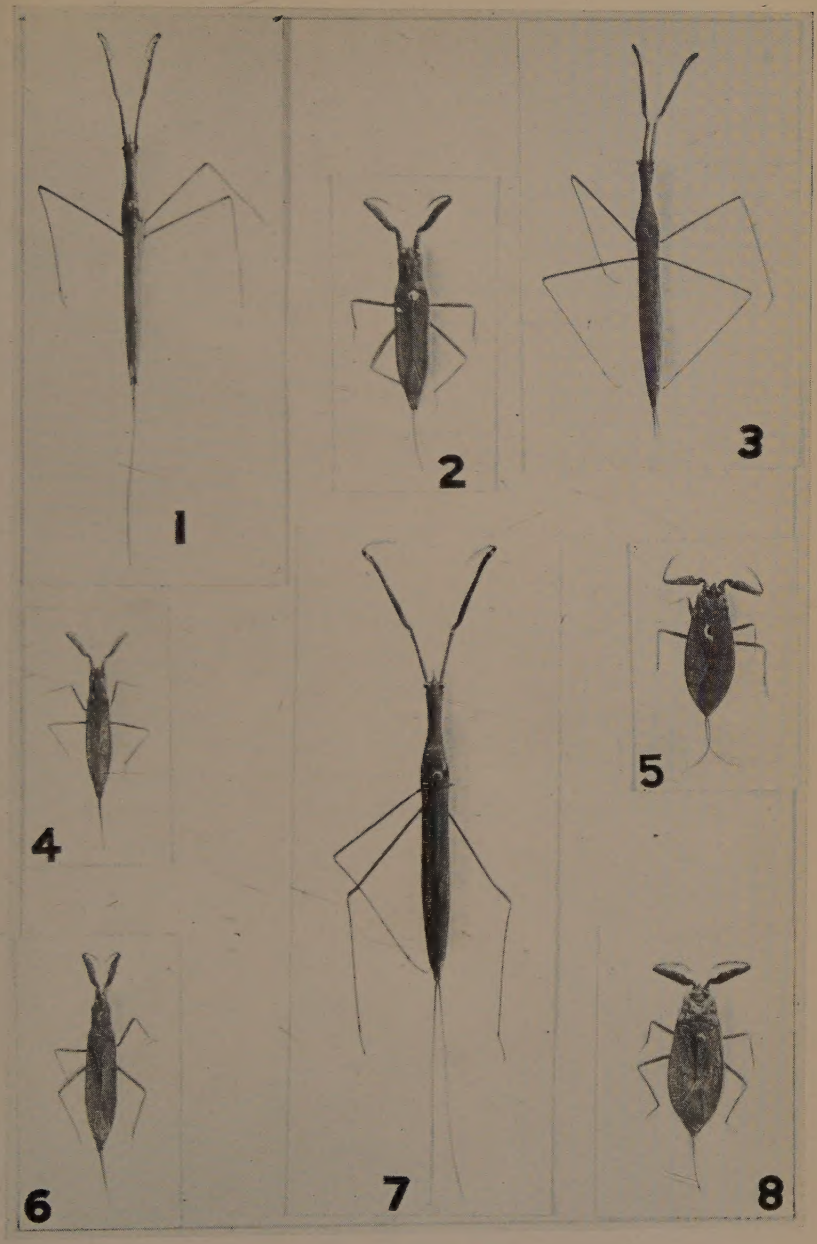



PLATE LI.